

PAPER

The Role of Interactive Mobile Learning in Enhancing University Students' Foreign Language Writing Skills

Tian Li()Xi'an Fanyi University,
Xi'an, Chinalitian@xafy.edu.cn**ABSTRACT**

This study aims to investigate the effectiveness of interactive mobile learning (IML) in improving the foreign language writing skills of college writers. Utilising the pervasive and practical nature of mobile devices, IML's engaging and enjoyable features make it an exceptional instrument for language acquisition. The study is grounded in cognitive load theory, constructivism, and social theory. These assumptions offer a strong foundation for examining the effectiveness of mobile learning applications in improving students' writing skills. The study replicated an experimental design and consisted of 200 college students who were enrolled in English as a Foreign Language (EFL) courses. The participants were segregated into two cohorts: one cohort employed the mobile application Write Better to enhance their writing skills, while the other cohort depended on traditional methods of teaching. Data was collected through pre- and post-tests, tracking of app usage, and analysis of qualitative remarks. The students in the experimental group exhibited much bigger enhancements in their writing skills compared to those in the control group. Enhanced written output was further correlated with increased use of the mobile application. Although there were some technical challenges, a qualitative investigation found that students liked the app's captivating attributes, such as the ability to receive immediate feedback and collaborate on projects. This study enhances the current body of literature by presenting data that supports the effectiveness of IML in EFL writing teaching. Furthermore, it offers instructors clear instructions on how to incorporate mobile devices into the classroom setting.

KEYWORDS

interactive mobile learning (IML), foreign language, education quality, mobile technology

1 INTRODUCTION

Dynamic mobile learning, also known as interactive mobile learning (IML), is one of the most rapidly evolving subfields of educational technology. The educational process is enhanced by integrating enjoyment, involvement, and customisation through the use of mobile devices. This platform leverages college students'

Li, T. (2024). The Role of Interactive Mobile Learning in Enhancing University Students' Foreign Language Writing Skills. *International Journal of Interactive Mobile Technologies (ijim)*, 18(14), pp. 28–43. <https://doi.org/10.3991/ijim.v18i14.50405>

Article submitted 2024-03-04. Revision uploaded 2024-05-28. Final acceptance 2024-06-04.

© 2024 by the authors of this article. Published under CC-BY.

widespread access to computers and mobile phones to transcend traditional limitations in classrooms and foster a conducive environment for continuous learning. The increasing demand from students for personalised learning opportunities and advancements in mobile technology have underscored the growing importance of IML in recent years [1]. The widespread use of mobile phones has significantly transformed the educational landscape, particularly in higher education. College students are increasingly utilising smartphones, laptops, and other mobile devices to access course materials, engage in discussions, and complete assignments. This trend is expected to persist in the foreseeable future. The digitization of classrooms, occurring concurrently with the rise of mobile learning environments, aligns with this shift. It is imperative to explore innovative teaching approaches that fully harness mobile technology, as previously noted [2].

One area where intelligent machine learning shows great promise is in the development of people's skills to learn new languages, especially those that require writing. Equally important to learning the syntax and vocabulary of a foreign language is proficiency in its style, coherence, and sentence structure. Sometimes, even with enough individual attention and practice, it is not feasible to learn the advanced abilities one desires in a regular classroom setting. Mobile learning apps that utilise interactive elements and instant feedback methods offer a practical solution to these challenges [3]. Students have the opportunity to work on significant writing projects, receive helpful criticism, and practice writing regularly to improve. Relatively little study has been conducted on whether interactive machine acquisition enhances language acquisition in a real-world setting [4, 5]. Writing was one of the skills that was not adequately addressed in earlier studies examining how mobile learning impacted language competency. Further research is needed to determine the most effective ways to incorporate interactive machine learning into language programmes and enhance students' writing skills. The conflicting results in the existing body of research make this exploration essential. Researchers and policymakers interested in improving language acquisition through cutting-edge technology can bridge this gap with this knowledge [6].

The investigation is theoretically grounded in constructivism, cognitive load theory, and sociocultural theory. Vygotsky's sociocultural theory emphasises the importance of social interactions and exposure to diverse cultures in the learning process. This theory posits that learning occurs within social contexts, where individuals engage in conversations to expand their knowledge and exchange personal experiences. By promoting active participation in class discussions and other learning activities, mobile learning applications foster a collaborative learning environment. Sweller's cognitive load theory suggests that instructional designers should reduce unnecessary mental effort to facilitate quicker learning. According to this theory, students have limited capacity for learning and retention. Interactive mobile apps that offer prompt feedback and well-structured activities can help reduce cognitive strain on students. Access to these applications through mobile devices enables individuals to focus on essential information while disregarding irrelevant details. Piaget and Vygotsky [7]. In their constructivist theories, they argue that critical reflection, prior knowledge, and hands-on engagement with the environment are effective learning strategies. Students are encouraged to actively participate in their language learning process through the constructivist approach commonly employed in the dynamic and interactive courses offered by IML. The use of interactive features and instant feedback can aid students in grasping writing concepts and patterns in a foreign language more effectively. The study's assumptions and objectivities are influenced by various scientific perspectives. IML offers three key methods to enhance foreign

language writing: increasing student engagement, enhancing feedback mechanisms, and facilitating group learning opportunities. If you are interested in exploring how mobile learning apps can improve [8] your writing skills and research interpretation, it is advisable to familiarise yourself with the fundamental principles of interactive mobile learning.

The basis of this study revolves around four crucial research questions: What potential benefits can students derive from writing in a language other than their mother tongue when using IML? How do you believe your students' writing skills have improved through the use of mobile learning? The following list enumerates some of the most common challenges faced by students attempting to utilise a mobile app for practicing writing in a foreign language. To facilitate well-informed decision-making regarding the merits of each approach, this study aims to evaluate the efficacy of IML applications compared to traditional classroom instructions. Additionally, the study seeks to determine whether children's writing skills progress in correlation with the time they invest in using such programs. Through student feedback, the study aims to assess the advantages and disadvantages of employing these applications for paper writing. By providing quantitative evidence of the effectiveness of IML applications in enhancing students' foreign language writing proficiency, this study aims to address a significant knowledge gap. Drawing on current learning theories, the study will offer scholarly perspectives on the potential benefits of mobile learning for enhancing writing skills. The outcomes of this research will assist educators and instructional designers in optimising the use of mobile learning technology to bolster students' language development. The potential enhancement of student outcomes could lead to a substantial transformation in language instruction delivery. The study's objective is to emphasise user engagement and student-centred learning methodologies in developing and utilising educational resources. By evaluating students' perspectives and experiences, this study aims to advance this objective [9].

This study report is organised to address the research questions and achieve the set goals. The introduction of the article offers a description of mobile learning engagement along with a brief overview of the theoretical foundations supporting the research. The methodology section, found on the following page, includes details about the study's participants, location, research design, intervention specifications, data collection tools, data analysis methods, and any ethical concerns relevant to the investigation. The findings are further explained in the results section of the research. Various elements contribute to this, such as qualitative approaches, interaction and usage patterns, and descriptive and inferential statistics. The findings are discussed in the Discussion section, which considers both the newly developed theoretical frameworks and previous research. This paper exceeds expectations by examining the limitations of the findings and introducing innovative concepts for future research. The Conclusion section offers a brief summary of the study's results, including their practical implications, impact, and key aspects. The application of this systematic approach enhances the understanding of the study's significance and relevance by ensuring that the research is presented in a logical and comprehensive manner.

2 LITERATURE REVIEW

Mobile device use in educational contexts has received a lot of attention over the last 10 years. This aligns with the broader trend of digitization in education. The use

of portable electronic devices, such as tablets and cell phones, to enhance the educational process is referred to as mobile learning, or m-learning. This exercise can be done from any place and at any time. Many academic institutions have embraced this approach due to its flexibility, accessibility, and ability to enhance students' learning experiences. Mobile learning offers numerous advantages. Students who can access course materials and complete assignments at their convenience are afforded greater flexibility in their academic endeavours. Personalized education is effectively delivered through mobile learning, allowing students to customize their learning experiences to meet their individual needs. Mobile devices with interactive features such as multimedia tools, real-time feedback, and game-like capabilities [10]. Can engage and motivate students to learn more. However, mobile learning also has its limitations. The small screen size and limited input options of mobile devices may pose challenges when using complex educational apps. Students may struggle to maintain focus and adhere to a structured learning path in the absence of a controlled educational setting. Technical challenges, such as unstable software or slow Internet connections, can significantly hinder the effectiveness of mobile learning [11].

Numerous studies have uncovered a wide range of data supporting the effectiveness of mobile learning in various fields and situations. Research has shown that studying mathematics, science, and language arts is greatly enhanced by mobile learning. A meta-analysis conducted by Zhukova et al. [12] demonstrated that mobile learning enhances students' motivation, engagement, and academic performance across all grade levels and subject areas. The success of mobile learning depends on factors such as student diversity, how well it complements traditional teaching methods, and the quality of the courses themselves. Interactive mobile learning, also known as IML, is a specialised form of mobile learning that utilises interactive elements to promote collaboration, personal growth, and customised instruction. IML emphasises active student participation in the learning process through immersive and dynamic activities [13]. This differs from the conventional approach to mobile learning, where information is passively received. IML is based on a variety of key educational principles and concepts. IML stresses active learning, involving students in hands-on projects, and encouraging critical thinking throughout the learning process. IML places a strong emphasis on collaborative learning, highlighting the importance of students' social interactions and cooperation. Additionally, IML provides personalised learning experiences tailored to meet the specific needs of individual students, considering their interests, developmental stage, and preferences [14].

Several studies have explored the influence of IML on students' innate motivation, degree of participation, and eventual academic success. Research reveals that interactive machine learning may efficiently catch and hold students' attention by providing them with interesting and stimulating learning scenarios, thereby boosting their level of engagement. A study [15] revealed that students who utilised IML tools had higher involvement in their learning and demonstrated stronger levels of determination to achieve in comparison to those who depended on traditional approaches. IML enriches students' educational experiences through rapid feedback, simplified cooperation, and personalised lesson plans adapted to individual students' aptitudes and limits [16]. The potential of mobile technology to enhance the abilities of second language writers has been extensively researched. Proficient writing in a foreign language demands a complete mastery of the language's syntax, vocabulary, structure, and style. Mobile technology provides a significant opportunity to strengthen

these abilities through engaging and adaptable learning environments [17]. Utilising mobile devices for teaching and learning writing presents different potentials and problems. The constrained functionality of mobile devices, such as defective keyboards and small screens, can severely hamper the efficiency and speed of writing tasks. An additional aspect that could delay the writing process is the absence of appropriate space to organise one's thoughts. However, mobile technology has enormous potential for enhancing writing education. Interactive writing software includes numerous crucial features, including immediate feedback, grammar and language analysis, and personalised writing projects adapted to each student's individual needs and current ability level [18].

Extensive investigation has explored the usefulness of websites and mobile applications in boosting people's abilities in foreign language writing. A meta-analysis demonstrated that the utilisation of mobile learning aids greatly increased English language learning results, notably in terms of writing abilities [19]. ESL students saw considerable gains in their writing abilities, notably in terms of applying accurate syntax and vocabulary, following the usage of a mobile device to help with language learning [20]. The findings show that mobile applications have the ability to boost students' writing competence in foreign languages. However, this outcome is dependent on the quality of the apps and their smooth integration with the curriculum. Feedback, collaborative assignments, and gamification are crucial interactive features that greatly affect language learning programmes for mobile devices. These features, including delivering immediate and insightful feedback, encouraging cooperation and communication among students, and integrating gamification components, can successfully boost students' writing skills. In order to properly instruct writing, it is important to both provide and acknowledge feedback. Mobile learning applications can increase students' writing by delivering rapid feedback on their vocabulary, grammar, and writing structure, therefore boosting clarity and coherence. They can quickly find and fix mistakes. Students can strengthen their writing competence by engaging in collaborative activities such as peer review and group writing assignments. Students get chances to pick up tips from one another and hear other viewpoints on their work through these exercises [21, 22]. By introducing features of a game, including points, leaderboards, and badges, gamification seeks to increase motivation and involvement in educational activities. Gamification has been demonstrated to be very beneficial for language learning because it can increase student motivation and promote more frequent and extended practice. According to research [23], EFL students who used a gamified writing system showed much improved writing abilities, increased motivation, and overall pleasure in the writing process. There are various outstanding concerns regarding the influence of dynamic elements on foreign language writing at the university level, given the positive character of the findings. A considerable amount of research has been undertaken either in elementary or secondary schools or has focused on general language competency. Further study is needed to establish the most effective approaches for customising mobile learning applications to adapt to the individual requirements of college students and incorporating engaging functions into higher education courses [24].

The aforementioned sources imply that a rigorous theoretical framework is important for understanding IML in FSL writing. To develop writing abilities in IML, we can resort to sociocultural theory, which investigates the influence of cultural surroundings and social interactions on learning, to get a greater grasp of how group qualities contribute to this progress. According to the cognitive load theory,

we can appreciate how engaging features could minimise cognitive effort and facilitate the learning process. Constructivism highlights the importance of personalised teaching and active engagement in enhancing one's writing abilities [25]. However, further study is necessary to uncover the exact processes through which IML supports ELLs in improving their writing skills in other languages, especially in higher education settings. This study aims to assess the potential benefits of using IML to enhance the writing abilities of college students who are learning foreign languages. The primary focus will be on interactive elements such as gamification, collaboration, and feedback.

3 METHODOLOGY

3.1 Participants and context

1. Target population: The analysis primarily focused on college students enrolled in foreign language classes, particularly those taking EFL. Students from various institutions were selected to ensure that the group reflected a diverse range of educational backgrounds and language proficiency levels. The participants were predominantly first-year college students aged 18–25, which is typical for students taking EFL courses.
2. Sampling method and sample size: In order to include a wide range of people from different educational institutions and skill levels (beginning, intermediate, and expert), the subjects were chosen via stratified random selection. This method allows for a detailed investigation into how mobile learning impacts a diverse group of students. The final sample size consisted of 200 students, with 100 in the control group utilising traditional learning methods and 100 in the experimental group using IML. A power analysis conducted prior to that study confirmed the statistical significance of the sample size.
3. Educational context: The study was conducted in university EFL curricula, specifically in a higher education context. The educational setting encompassed both in-class and out-of-class learning environments, enabling a comprehensive assessment of the mobile learning intervention. The experimental group attended regular classes with the support of a mobile learning platform. The institutions participating in the initiative provided the essential infrastructure and support to ensure the seamless integration of mobile learning technologies into their existing curricula [26].

3.2 Research design

1. Research design: This study utilised a quasi-experimental design with pre- and post-test measurements. By controlling extraneous factors, this method is suitable for investigating the impact of an intervention in IML on an outcome (foreign language writing abilities). The design comprised two groups: a control group that received traditional teaching methods and an experimental group that received the IML intervention [27].
2. Suitability of the design: The quasi-experimental approach was chosen because it works well in educational research, where random assignment is frequently impractical. This design allows for a comparison between groups, enabling the assessment of the intervention's efficacy. Pre- and post-tests provided data on

students' writing abilities before and after the intervention, facilitating the evaluation of learning gains attributed to the mobile learning platform.

3. Timeline and duration: The research lasted around 16 weeks. This duration was chosen to allow students ample time to engage with the mobile learning application and for substantial enhancements in their writing skills to occur. Pre-testing took one week, the intervention lasted 14 weeks, and post-testing and data collection took the final week [28].

3.3 IML intervention

1. Definition of IML: In this work, IML is defined as the use of mobile devices with instructional software that promotes interactive and engaging learning experiences. These programmes often include features such as social interaction capabilities, multimedia resources, interactive tasks, and instant feedback [29].
2. Mobile learning application used: The specific mobile learning programme utilised was called "Write Better," designed to enhance writing skills in foreign languages. "Write Better" offers interactive writing prompts, peer review systems, vocabulary and grammar exercises, as well as feedback from teachers and automated systems. Students can easily access the software both in and out of the classroom, as it is compatible with tablets and cell phones [30].

3.4 Features and functionalities

1. Write Better: Engaging questions for academic and creative writing can be discovered in interactive writing prompts.
 - Students can provide and receive feedback on each other's work through a peer review system.
 - Grammar and vocabulary exercises: Interactive activities tailored to the user's level of expertise.
 - Immediately feedback: An AI-powered application provides real-time fixes and recommendations.
 - Progress tracking: Tools include personalized suggestions and visual dashboards for tracking progress over time.
 These features were included in the learning environment to facilitate the growth of writing abilities through ongoing practice and criticism.

3.5 Data collection instruments

1. Assessment tools for writing skills: The study utilised rubrics and traditional writing assessments together to evaluate writing abilities in a foreign language. The writing section of the Test of English as a Foreign Language (TOEFL) was saved as the primary tool, providing a reliable and validated assessment of the students' writing skills. Additionally, a specific rubric was developed to evaluate specific writing components such as coherence, grammar, word usage, and overall organisation [31].
2. Rationale for instrument selection: Because the TOEFL writing section is widely recognised for its strong psychometric properties, it can be utilised to assess writing proficiency with validity and reliability. In collaboration with language

experts, a customised rubric was developed to provide comprehensive insights into various aspects of writing skills and align with the educational goals of the study. To ensure that both tools were suitable for the target audience, they underwent pilot testing [32].

3. Data collection on engagement and usage: Weekly surveys and in-app analytics provided data on app usage and engagement. Analytical data included time spent on the app, quantity of tasks finished, and frequency of feature engagement. Weekly surveys collected qualitative information on the experiences, difficulties, and opinions of the app's value to the students. This multi-method approach enabled an in-depth understanding of how students interacted with the mobile learning intervention, which was made possible by this multi-method approach [33].

3.6 Data analysis

1. Statistical methods: Using independent t-tests to evaluate differences between the experimental and control groups and paired t-tests to assess the significance of changes within groups, quantitative data from the pre- and post-test writing evaluations were examined. Interaction effects between time (pre-test vs. post-test) and group (experimental vs. control) were also evaluated using a mixed-design analysis of variance (ANOVA).
2. Qualitative methods: Common themes and patterns in students' experiences with the mobile learning application were identified through thematic analysis of qualitative data from questionnaires. This approach provided a deeper understanding of the intervention's effects by incorporating contextual information alongside the quantitative results [34].
3. Controlling for confounding variables: In order to address any confounding variables, the study took into account factors such as initial language proficiency, motivation levels, and access to additional learning resources. To isolate the effects of the mobile learning intervention, these variables were assessed at the outset and factored into the statistical analysis. Additionally, the use of stratified sampling helped ensure a balanced representation of different proficiency levels in both the experimental and control groups [28].

3.7 Ethical considerations

1. Ensuring ethical research practices: Institutional review boards (IRBs) at the collaborating universities granted ethical clearance. Every participant provided their informed consent, which included assurances of anonymity and the voluntary nature of participation. Participants were informed that they could withdraw from the research at any time without facing any academic consequences [18].
2. Risks and benefits: The time commitment required to use the mobile app and complete the tests was the primary factor contributing to the few possible dangers to the participants. These hazards were reduced by including the app in routine schoolwork and offering technical assistance when needed. The advantages included better writing abilities, exposure to cutting-edge learning resources, and maybe increased language competency all around. To promote their motivation and involvement, these advantages were explained to the participants.

4 RESULTS AND DISCUSSION

4.1 Descriptive statistics

1. Participant demographics

Table 1. Participant demographics

| Demographic Variable | N | Percentage (%) |
|-----------------------------|-----|----------------|
| Age | | |
| 18–20 | 90 | |
| 21–22 | 70 | 45 |
| 23–24 | 40 | 35 |
| Gender | | 20 |
| Male | 100 | |
| Female | 100 | 50 |
| Language Proficiency | | 50 |
| Beginner | 50 | |
| Intermediate | 100 | 25 |
| Advanced | 50 | 50 |

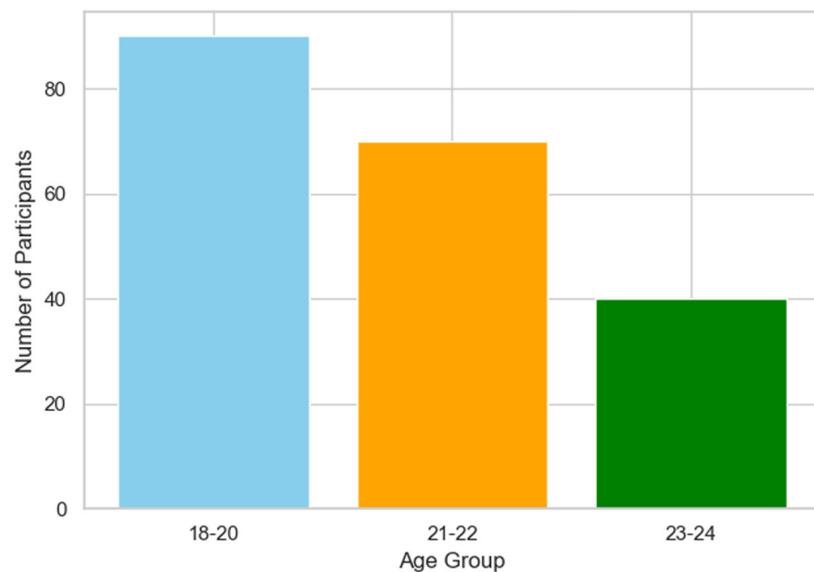


Fig. 1. Participant demographics by age group

The sample included 200 university students with a balanced distribution across age, gender, and language proficiency levels. The participant demographics are summarised in Table 1. Figure 1 illustrates the distribution of participants by age group.

The bar chart in Figure 1 illustrates the distribution of participants across various age groups, emphasising the predominant age group of 18–20 years.

2. Pre- and post-test writing scores: Descriptive statistics for pre- and post-test writing scores are provided in Table 2. The table includes the mean, standard deviation, and range for both the intervention and control groups.

Table 2. Descriptive statistics for writing scores

| Group | Test | Mean | SD | Range |
|------------------|-----------|------|------|-------|
| Intervention | Pre-test | 65.3 | 10.5 | 45–85 |
| | Post-test | 78.2 | 9.3 | 60–95 |
| Control | Pre-test | 66.1 | 11.2 | 46–86 |
| | Post-test | 69.4 | 10.8 | 50–88 |
| App Usage | | | | |
| Time Spent (hrs) | | 22.5 | 5.8 | 10–35 |
| Frequency of Use | | 34.2 | 7.4 | 20–50 |

4.2 Inferential statistics

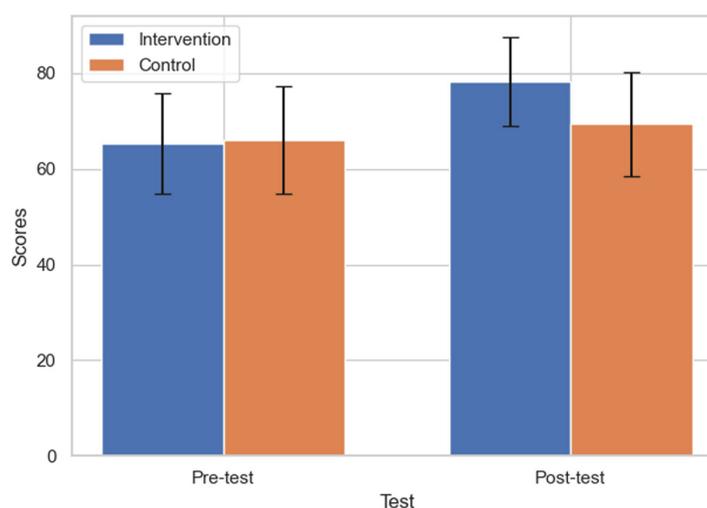


Fig. 2. Pre- and post-test writing scores by group

The results of the inferential statistical tests are summarized in Table 3. Paired t-tests and ANCOVA were used to compare pre- and post-test scores between the intervention and control groups.

Table 3. Inferential statistics

| Comparison | t-Value | p-Value | Effect Size (Cohen's d) |
|-----------------------------------|---------|---------|-------------------------|
| Pre vs. Post (Intervention) | 8.47 | <0.001 | 1.22 |
| Pre vs. Post (Control) | 2.89 | 0.005 | 0.42 |
| ANCOVA (Intervention vs. Control) | 15.23 | <0.001 | 0.98 |

The intervention group showed a significant improvement in writing scores compared to the control group, indicating the effectiveness of the IML tool. Figure 2 illustrates the pre- and post-test writing scores for both groups.

The bar chart in Figure 2 compares the mean pre- and post-test scores for the intervention and control groups, highlighting the significant improvement in the intervention group.

4.3 Qualitative analysis

1. Themes and quotes: Thematic analysis of qualitative data revealed several key themes related to student perceptions, challenges, and benefits of using the mobile app. These themes are summarised in Table 4, along with illustrative quotes from participants.

Table 4. Qualitative themes and illustrative quotes

| Theme | Quote |
|---------------------|---|
| Positive Perception | “The app made writing more engaging and fun.” |
| Ease of Use | “It was easy to navigate and use the features.” |
| Immediate Feedback | “Instant feedback helped me understand my mistakes.” |
| Collaboration | “Working with peers on the app improved my writing.” |
| Challenges | “Sometimes the app would crash during use.” |
| Perceived Benefits | “My writing skills improved significantly over the semester.” |

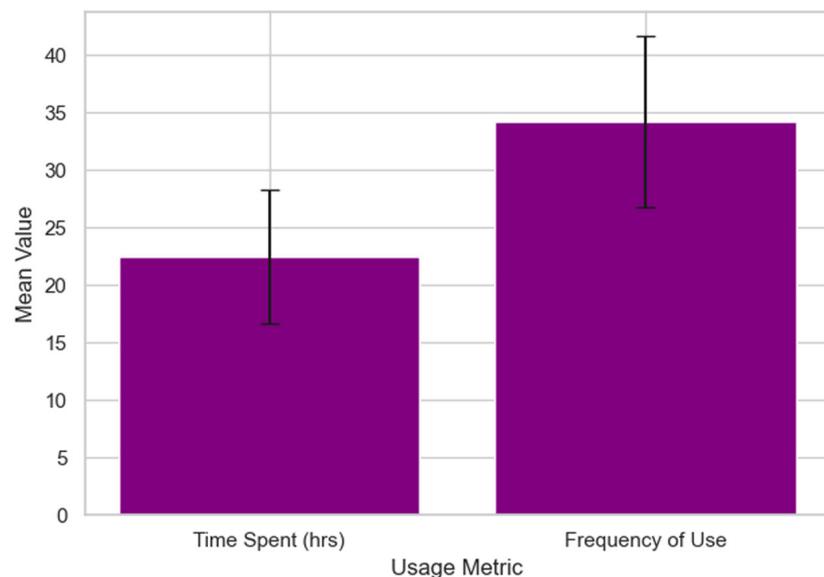


Fig. 3. App usage patterns

Students generally had positive perceptions of the app, appreciating its ease of use and immediate feedback features. However, some technical issues were reported, highlighting areas for improvement.

2. Engagement and usage patterns: Figure 3 illustrates the application usage patterns, displaying the average time spent per session and the frequency of use over the semester. A positive correlation was observed between app usage and writing improvement, indicating that increased engagement with the application resulted in enhanced writing outcomes.

4.4 Comparison with previous research

Table 5. Comparison with previous research

| Study | Sample | Intervention | Outcomes | Key Findings |
|----------------------|--------------|-------------------------------|------------------------------------|--------------------------------------|
| Chen et al. (2020) | 150 students | Mobile language learning apps | Language proficiency | Improved overall language skills |
| Garzón et al. (2023) | 120 students | Mobile learning tools | English language learning outcomes | Positive impact on learning outcomes |
| Current Study | 200 students | IML app | Foreign language writing skills | Significant improvement in writing |

The current study's findings align with previous research, demonstrating the positive impact of mobile learning tools on language acquisition, given in Table 5. Differences in outcomes may be attributed to variations in sample size, intervention type, and specific learning contexts.

4.5 Limitations and future directions

1. Limitations: It is necessary to acknowledge a few limitations of the study. Although sufficient for this research, the sample size limits the generalizability of the results to other situations and demographics. Moreover, there may be bias introduced by relying solely on self-reported app usage statistics. Additionally, technical issues with the software could have created challenges that might have affected the results.
2. Future directions: To improve generalizability, future studies should consider larger and more diverse samples. A more comprehensive understanding of its consequences would result from examining other linguistic abilities beyond writing and the long-term implications of IML. Additional enhancements to the app's features and technical issues could enhance the user experience and learning outcomes.

4.6 Implications for practice

1. Practical implications: Curriculum designers and foreign language teachers will find great significance in the study's results. Including IML resources in language education can increase student interest and improve their writing skills. Teachers must consider integrating such resources into their instructional methods, ensuring they are user-friendly and provide prompt, valuable feedback.
2. Recommendations: The study's findings lead to the following suggestions for incorporating IML into language teaching:
 - Choose apps that are easy to use. Select user-friendly mobile learning resources with a wide range of features for writing exercises and comments.
 - Organize training workshops for teachers and students to ensure efficient use of the app.
 - Promote teamwork: To enhance learning through interaction, offer tools that facilitate peer review and group writing assignments.
 - Monitor and assist: Keep track of students' app usage frequency and provide additional support to those experiencing technical difficulties or struggling to navigate the app.

3. Potential benefits and challenges: Among the many advantages of IML tools are higher engagement, quick feedback, and opportunities for group learning. However, technical issues, the need for reliable internet connectivity, and potential resistance to new technology must all be addressed. Teachers can maximise the benefits of these technologies and overcome associated challenges by selecting and utilising them effectively.

5 CONCLUSION

This paper highlights how IML may revolutionise university students' foreign language writing abilities. Teachers can provide their students with interesting, dynamic, and customised learning experiences that surpass traditional classroom settings by incorporating mobile apps such as Write Better into language training. Empirical data collected shows that IML increases student interest and involvement, in addition to improving writing ability. The study results are supported by constructivism, cognitive load theory, and sociocultural theory, which collectively emphasise the value of dynamic, cooperative, and contextually rich learning environments. Technical challenges and the need to effectively integrate mobile learning technologies into the current curriculum were among the many obstacles identified, despite the positive outcomes. These issues should be addressed in future studies, which should also explore how IML impacts different language skills over time and broaden the focus to include other educational settings and learner groups. Further research into the specific interactive elements that most significantly enhance the development of writing skills can also inform the development of more effective mobile learning applications. Teachers, curriculum developers, and policymakers seeking to enhance foreign language education through cutting-edge technological interventions will find significant value in this paper. Leveraging the potential of IML can greatly improve the educational environment and provide students with more engaging and efficient pathways to learning foreign languages.

6 ACKNOWLEDGMENT

The phased achievement of the 2023 project of the Annual Project of Shaanxi Province's "14th Five-Year Plan" for Educational Science and Technology Planning is titled "A Study on the Integrated reading-writing-abilities construct based on Multilingual Corpora" (project number: SGH23Y2757).

7 REFERENCES

- [1] J. S. Artal-Sevil, J. L. Bernal-Agustín, and J. D. Navarro, "m-Learning (Mobile Learning) in Higher Education. The impact of smartphone as interactive learning tool," in *EDULEARN15 Proceedings*, 2015, pp. 8212–8221.
- [2] A. M. Al-Rahmi, W. M. Al-Rahmi, U. Alturki, A. Aldraiweesh, S. Almutairy, and A. S. Al-Adwan, "Acceptance of Mobile Technologies and M-learning by university students: An empirical investigation in higher education," *Education and Information Technologies*, vol. 27, pp. 7805–7826, 2022. <https://doi.org/10.1007/s10639-022-10934-8>
- [3] O. Boyinbode, D. Ng'ambi, and A. Bagula, "An interactive mobile lecturing model: Enhancing student engagement with face-to-face sessions," *International Journal of Mobile and Blended Learning (IJMBL)*, vol. 5, no. 2, pp. 1–21, 2013. <https://doi.org/10.4018/jmbl.2013040101>

- [4] R. Gafni, D. B. Achituv, and G. Rahmani, "Learning foreign languages using mobile applications," *Journal of Information Technology Education. Research*, vol. 16, pp. 301–317, 2017. <https://doi.org/10.28945/3855>
- [5] M. Kuimova, D. Burleigh, H. Uzunboylu, and R. Bazhenov, "Positive effects of mobile learning on foreign language learning," *TEM Journal*, vol. 7, no. 4, pp. 837–841, 2018.
- [6] B. Klimova and L. H. Al-Obaydi, "Use of mobile applications for foreign language learning among university students: Needs and functions," *International Journal of Interactive Mobile Technologies*, vol. 17, no. 12, pp. 28–39, 2023. <https://doi.org/10.3991/ijim.v17i12.38541>
- [7] C. Yurdagül and S. Öz, "Attitude towards mobile learning in English language education," *Educ. Sci.*, vol. 8, no. 3, p. 142, 2018. <https://doi.org/10.3390/educsci8030142>
- [8] I. Zulaeha, Subyantoro, C. Hasanudin, and R. Pristiwati, "Developing teaching materials of academic writing using mobile learning," *Ingénierie des Systèmes d'Information*, vol. 28, no. 2, pp. 409–418, 2023. <https://doi.org/10.18280/isi.280216>
- [9] R. A. Pilar, A. Jorge, and C. Cristina, "The use of current mobile learning applications in EFL," *Procedia – Social and Behavioral Sciences*, vol. 103, pp. 1189–1196, 2013. <https://doi.org/10.1016/j.sbspro.2013.10.446>
- [10] O. Shkvyr, H. Dudchak, N. Kazakova, O. Polianovska, and N. Sivak, "Mathematical modeling of information technology integration in digital education: A regional perspective," *Ingénierie des Systèmes d'Information*, vol. 28, no. 3, pp. 603–610, 2023. <https://doi.org/10.18280/isi.280308>
- [11] D. Cojocnean, "Mobile learning in the foreign language classroom – Challenges and opportunities," *Revista de Pedagogie*, vol. 65, no. 1, pp. 59–72, 2017.
- [12] O. Zhukova, V. Mandragelia, T. Alieksieienko, A. Semenenko, and E. Skibina, "Digital technologies for introducing gamification into the education system in the context of the development of Industry 4.0," *Ingénierie des Systèmes d'Information*, vol. 28, no. 1, pp. 141–147, 2023. <https://doi.org/10.18280/isi.280114>
- [13] F. Cakmak, "Mobile learning and mobile assisted language learning in focus," *Language and Technology*, vol. 1, no. 1, pp. 30–48, 2019.
- [14] D. Rukayah, J. Daryanto, I. R. W. Atmojo, R. Ardiansyah, D. Y. Saputri, and M. Salimi, "Augmented reality media development in STEAM learning in elementary schools," *Ingénierie des Systèmes d'Information*, vol. 27, no. 3, pp. 463–471, 2022. <https://doi.org/10.18280/isi.270313>
- [15] M. Saran and G. Seferoglu, "Supporting foreign language vocabulary learning through multimedia messages via mobile phones," *Hacettepe University Journal of Education*, vol. 38, no. 3, pp. 252–266, 2010.
- [16] H. Herwin, L. D. Prasojo, B. Saptono, and S. C. Dahalan, "Analyzing the impact of augmented reality on student motivation: A time series study in elementary education," *Ingénierie des Systèmes d'Information*, vol. 28, no. 5, pp. 1197–1203, 2023. <https://doi.org/10.18280/isi.280507>
- [17] O. Ozer and F. Kılıç, "The effect of mobile-assisted language learning environment on EFL students' academic achievement, cognitive load and acceptance of mobile learning tools," *EURASIA Journal of Mathematics, Science and Technology Education*, vol. 14, no. 7, pp. 2915–2928, 2018. <https://doi.org/10.29333/ejmste/90992>
- [18] S. Marmoah, F. Supianto, F. Sukmawati, J. I. S. Poerwanti, and Yantoro, "The elementary school teachers adoption of learning management system: A UTAUT model analysis," *Ingénierie des Systèmes d'Information*, vol. 29, no. 2, pp. 715–722, 2024. <https://doi.org/10.18280/isi.290233>
- [19] M. Shahbaz and R. M. I. Khan, "Use of mobile immersion in foreign language teaching to enhance target language vocabulary learning," *MIER Journal of Educational Studies Trends and Practices*, vol. 7, no. 1, pp. 66–82, 2017.

- [20] A. D. Yasa, S. Rahayu, S. K. Handayanto, and R. Ekawati, "Evaluating the impact of smart learning-based inquiry on enhancing digital literacy and critical thinking skills," *Ingénierie des Systèmes d'Information*, vol. 29, no. 1, pp. 219–233, 2024. <https://doi.org/10.18280/isi.290122>
- [21] C. Cich, N. Irmawati, S. Adi, W. Wina, and B. Syamsul, "Mobile-Assisted Language Learning (MALL): Students' perception and problems towards mobile learning in English language," in *International Conference on Advanced Information Scientific Development (ICAISD)*, West Java, Indonesia, vol. 1641, 2020, no. 1, p. 012027. <https://doi.org/10.1088/1742-6596/1641/1/012027>
- [22] R. Ramadania, Y. Hartijasti, B. B. Purmono, D. M. N. Haris, and M. Z. Afifi, "A systematic review on digital transformation and organizational performance in higher education," *International Journal of Sustainable Development and Planning*, vol. 19, no. 4, pp. 1239–1252, 2024. <https://doi.org/10.18280/ijstdp.190402>
- [23] H. J. Jung, "Fostering an English teaching environment: Factors influencing English as a foreign language teachers' adoption of mobile learning," *Informatics in Education*, vol. 14, no. 2, pp. 219–241, 2015. <https://doi.org/10.15388/infedu.2015.13>
- [24] Y. Haleta, N. Mukan, O. Voloshyna, A. Gelbak, and N. Dmytrasevych, "Planning for sustainable development through the integration of pedagogical and psychological technologies for language learning in the context of digitalization," *International Journal of Sustainable Development and Planning*, vol. 18, no. 4, pp. 1079–1087, 2023. <https://doi.org/10.18280/ijstdp.180410>
- [25] M. Tayebinik and M. Puteh, "Mobile learning to support teaching English as a second language," *Journal of Education and Practice*, vol. 3, no. 7, pp. 56–62, 2012.
- [26] M. Bhatia, P. Manani, A. Garg, S. Bhatia, and R. Adlakha, "Mapping mindset about gamification: Teaching learning perspective in UAE education system and Indian education system," *Revue d'Intelligence Artificielle*, vol. 37, no. 1, pp. 47–52, 2023. <https://doi.org/10.18280/ria.370107>
- [27] K. Demir and E. Akpınar, "The effect of mobile learning applications on students' academic achievement and attitudes toward mobile learning," *Malaysian Online Journal of Educational Technology*, vol. 6, no. 2, pp. 48–59, 2018. <https://doi.org/10.17220/mojet.2018.02.004>
- [28] O. Habelko, N. Bozhko, I. Gavrysh, O. Khlitobina, and Y. Necheporuk, "Characteristics of the influence of digital technologies on the system of learning a foreign language," *Ingénierie des Systèmes d'Information*, vol. 27, no. 5, pp. 835–841, 2022. <https://doi.org/10.18280/isi.270518>
- [29] A. Berns, M. Palomo-Duarte, J. M. Dodero, J. M. Ruiz-Ladrón, and A. Calderón Márquez, "Mobile apps to support and assess foreign language learning," in *Critical CALL – Proceedings of the 2015 EUROCALL Conference*, Padova, Italy, 2015, pp. 51–56. <https://doi.org/10.14705/rpnet.2015.000309>
- [30] A. D. Yasa, S. Rahayu, S. K. Handayanto, and R. Ekawati, "Evaluating the impact of smart learning-based inquiry on enhancing digital literacy and critical thinking skills," *Ingénierie des Systèmes d'Information*, vol. 29, no. 1, pp. 219–233, 2024. <https://doi.org/10.18280/isi.290122>
- [31] A. Kukulska-Hulme, "Will mobile learning change language learning?" *ReCALL*, vol. 21, no. 2, pp. 157–165, 2009. <https://doi.org/10.1017/S0958344009000202>
- [32] D. K. Mah, "Learning analytics and digital badges: Potential impact on student retention in higher education," *Technology, Knowledge and Learning*, vol. 21, pp. 285–305, 2016. <https://doi.org/10.1007/s10758-016-9286-8>

- [33] X. Lei, J. Fathi, S. Noorbakhsh, and M. Rahimi, "The impact of mobile-assisted language learning on English as a foreign language learners' vocabulary learning attitudes and self-regulatory capacity," *Frontiers in Psychology*, vol. 13, p. 872922, 2022. <https://doi.org/10.3389/fpsyg.2022.872922>
- [34] Y. Q. Zhang and A. Mangmeechai, "Exploring the factors of undergraduate learners' engagement and knowledge sharing for sustainable hMOOC learning," *International Journal of Sustainable Development and Planning*, vol. 17, no. 3, pp. 1007–1015, 2022. <https://doi.org/10.18280/ijstdp.170332>

8 AUTHOR

Tian Li graduated from Potsdam University of Applied Sciences in Germany with a master's degree. She is now working at Xi'an Fanyi University, Xi'an 710105, China. Her research interests include Linguistics and Information Science. You can reach her via email at: litian@xafy.edu.cn; ORCID: <https://orcid.org/0009-0006-5230-3814>.